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(54) TRACKS FOR ENDLESS TRACK VEHICLES

(71) We, LUDWIG PIETZSCH, a German national of Rittnertstrasse 36, 7500 Karlsruhe 41, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to tracks for endless track vehicles of the type comprising track links each adjacent pair of which are connected by end connectors, and by bolts each passing transversely through one of the track links and having each end received in a socket in an end connector to which it is rigidly secured against relative axial movement.

An object of the invention is to provide an improved form of joint rigidly securing the end connector to the bolt which will be strong and yet light and compact. The strength should be sufficient to prevent relative axial movement between the bolt and the end connector. This may have an influence on the load bearing capacity of the link by increasing its resistance to bending about a fore and aft axis. Thus, if a track link, for example when passing over a hole or rut, is supported at its edges whilst being loaded over its middle portion, the bending load is primarily resisted by the bolt itself but after taking up the clearance between the sides of the link and the end connectors, its effective depth regarded as a beam is increased, and its capacity to resist bending is similarly increased provided that there is no relative axial movement between the end connectors and the bolt.

According to the present invention, each bolt is rigidly secured in an end connector against relative axial movement by tightening the end connector about the end of the bolt to grip it, one or each of the co-operating gripping surfaces being formed with projections and recesses so as to engage the companion surface only in limited areas thereby exerting increased pressure over such areas. Conveniently, each end connector is of elongated form with parallel sockets at opposite ends and a gap extending between them about a plane containing their axes, and the clamping means comprise a central screw tending to close the gap and tighten the sockets about the bolts.

The co-operating gripping surfaces may take various forms. Thus one of the gripping surfaces may be of non-linear longitudinal section, for example, a non-cylindrical surface of revoluton. Thus, in one embodiment each socket has a part cylindrical surface while the bolt has at least one annular neck and/or rib extending about it circumferentially.

In an alternative form of the invention, one of the gripping surfaces has a part cylindrical surface whilst the other is formed with longitudinal splines. In another arrangement, one gripping surface is formed with helical splines.

Each bolt may be formed with a flat in addition to a generally part cylindrical surface, co-operating with a corresponding flat in the associated end connector.

The invention may be put into practice in various ways, but certain specific embodiments will be described by way of example, with reference to the accompanying drawings in which;

Figure 1 is a perspective view of a length of track for an endless track vehicle showing the positions of the end connector in relation to the track without showing any details in accordance with the invention;

Figure 2 is a perspective exploded view of an end connector and two different bolt ends representing two different embodiments of the invention;

Figure 3 is a perspective exploded view of an end connector and the end of a bolt

co-operating with it;

Figure 4 is a scrap sectional elevation through an end connector in the plane of the axis of a bolt; and

Figure 5 is a sectional elevation of a connector in a plane at right angles to that of Figure 4.

Each chain link of the connected-link chain shown in Figure 1 comprises two track links 1 in the form of plates with running pads 2 at their undersides, two end connectors 3 at either side of the chain, and an intermediate connector 5 with a tooth 4 guiding the vehicle by means of the tread rollers 12 which roll on the plane surfaces 11 of the track links 1.

Each track link generally designated 7 is connected to the adjacent link 7 through the connectors 3,5 by means of bolts 8 which extend through aligned bores in the connectors and the track links 1.

In the area in which a bolt 8 passes through the track links 1 a plurality of rubber sleeves (not shown) which have an excess dimension as compared to through bores in the track links 1 are fixed on the bolts by vulcanisation. Together, with their rubber sleeves fixed by vulcanisation the bolts 8 are pressed into the through bores. As the rubber sleeves are capable of twisting, they permit tilting of the bolts 8 in the through bores by the angles necessary for flexing of the chain.

The track links 1 and the connectors 3, 5 are accurately dimensioned in a direction transversely of the direction of movement 'C' of the chain (relatively to the vehicle) so that accurate clearance *a* within manufacturing tolerances is obtained between the track links and the connectors when the links are not subjected to vertical bending load.

When a vehicle equipped with the caterpillar track according to Figures 1 drives over a rut or groove in the ground, the bolts 8 deflect. Beginning with a degree of flexure which can be predetermined, the clearance *a* is closed up in the upper zone because of the bending deformation, so that upon further increase of the bending load the track links 7 and the connectors 3, 5 constitute a supporting bridge which contributes to taking up the bending stress, and relieves the bolts of some of the bending load. The end connectors 3 are retained on the ends of the bolts 8 not only against rotation but also against longitudinal displacement in order to prevent these ends of the bolt 8 from slipping inwardly of the end connectors 3 in the loaded condition. For this purpose the ends of the bolts 8 are provided with flat sections which co-operate with corresponding flat sections in the end connectors.

The end connector 301 shown in Figure 2 is made in one piece. It has an elongated through opening 302, the ends of which are widened to form recesses or openings 303 to receive bolts 304. The recesses are adapted in shape to the bolt ends in that they each have a part cylindrical socket portion 305 extending round the major part of the circumference and a flattened portion 306. The bolts are formed accordingly with a cylindrical portion 305' and a flattened portion 306'. The recesses are machined to correspond to the bolt ends.

The two bridge members 307, 308, in the central portion of the connector may be forced against each other by a clamping screw which is not shown and is adapted to be inserted through holes 309, 310 in the two bridge members and tightened by a lock nut likewise not shown. Alternatively the hole 310 in the bridge member 308 may be designed as a threaded hole.

While the openings 303 of the connector 301 have a smooth surface, longitudinal grooves 312 of a length extending across the width of the connector are machined into the bolt shown on the left in Figure 2. Surface portions of splines 313 remain between the longitudinal grooves 312 and with the bolt installed they are in contact with the smooth surface 302, 306 of the opening 303.

Instead of longitudinal grooves the bolt shown on the right hand side in Figure 2 has a number of helical grooves 314 at the bolt end co-operating with the opening. Again contact surfaces 315 between the grooves 314 co-operate with the smooth surface 305, 306 of the opening. It is also possible to provide a single groove 314 which will have a correspondingly low pitch.

In the embodiment shown in Figure 3, the bolt ends have a smooth cylindrical surface 316' and smooth flattened portions 317' whereas the openings 303 have longitudinal grooves 322 and raised contact surface. The longitudinal grooves 322 can be produced by broaching in easier and less expensive manner than longitudinal grooves 312 on the outer surface of the bolt 304 in Figure 2.

The tightening of the screw produces clamping forces which act perpendicularly to the contact surfaces and produces a higher specific surface loading than with smooth contact surfaces. This clamping action presses residual lubricant and any possible foreign matter from between the contact surfaces into the grooves 312, 314 or 322 so that the greatest possible coefficient of friction determined by the pairing of material of the bolt and the connector 301 prevails between the contact surfaces. If the grooves were not provided, it would be unavoidable that lubricant or foreign particles would remain between the contact surfaces, thus changing the coefficient of friction and consequently the required clamping force in unpredictable manner.

This is not only due to the lacking space for the escape of undesired matter but also to the fact that the specific surface loading obtained by the same screw tightening torque is smaller.

It is convenient to select the width of the longitudinal grooves 312, 322 or of the helical grooves 314 and the spacings defining their contact surfaces 313, 323, and 315 respectively in such a way that the specific pressure at the contact surfaces is lightly below the flow limit of the materials of bolts and end connectors.

Figures 4 and 5 show definition arrangements in which what may be termed a form-lock connection and is obtained by pressing end connector material into depressions of the bolt ends.

The connection according to Figure 4 shows the bolt end to have two concave necks 142, 143 inclined in opposite directions leaving between them a circumferential rib 144. Material of opposite areas of the recess for the bolt ends or of the bridge members 106, 107, respectively, is pressed under elastic deformation towards the necks 142, 143 by the central screw 120 clamping the bridge members 106, 107, so that a form-lock connection is established. When the screw 120 is unscrewed the material elastically returns to its undeformed shape which renders possible disassembling of the bolts from the connector.

WHAT WE CLAIM IS:-

1. A track for an endless track vehicle comprising track links each adjacent pair of which are connected by end connectors, and by bolts each passing transversely through one of the track links and having each end received in a socket in an end connector to which it is rigidly secured against relative axial movement by tightening the end connector about the end of the bolt to grip it, one or each of the co-operating gripping surfaces being formed with projections and recesses so as to engage the companion surface only in limited areas thereby exerting increased pressure over such areas.

2. A track as claimed in Claim 1 in which each end connector is of elongated form with parallel sockets at opposite ends and a gap extending between them about a plane containing their axes, and the clamping means comprise a central screw tending to close the gap and tighten the sockets about the bolts.

3. A track as claimed in Claim 1 or Claim 2 in which one of the gripping surfaces is non-linear in longitudinal section.

4. A track as claimed in Claim 3 in which one of the gripping surfaces is a non-cylindrical surface of revolution.

5. A track as claimed in Claim 4 in which each socket has a part cylindrical surface while the bolt has at least one annular neck and/or rib extending about it circumferentially.

6. A track as claimed in Claim 1 or Claim 2 in which one of the gripping surfaces has a part cylindrical surface whilst the other is provided with longitudinal splines.

7. A track as claimed in Claim 1 or Claim 2 in which one of the gripping surfaces is of part cylindrical form whilst the other is provided with helical splines.

8. A track as claimed in any one of the preceding claims in which each bolt is formed with a flat in addition to a generally part cylindrical surface, co-operating with a corresponding flat in the associated end connector.

9. A track for an endless track vehicle as specifically described herein with reference to Figure 1 in association with Figure 2 or Figure 3 or Figures 4 and 5 of the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

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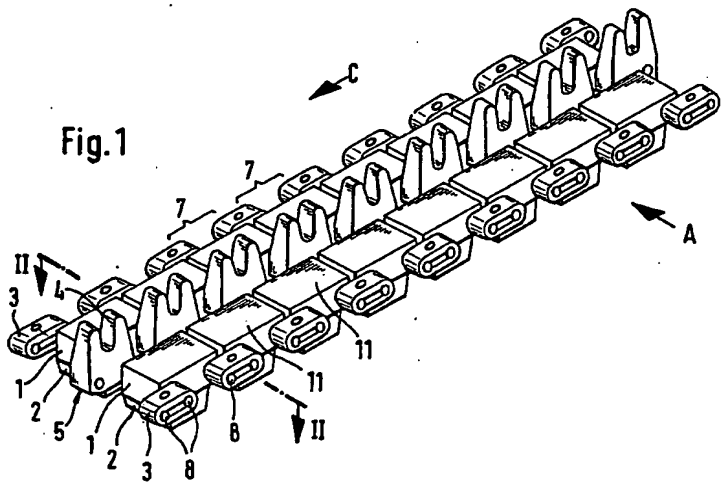
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig.1



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Sheet 2

Fig.2B

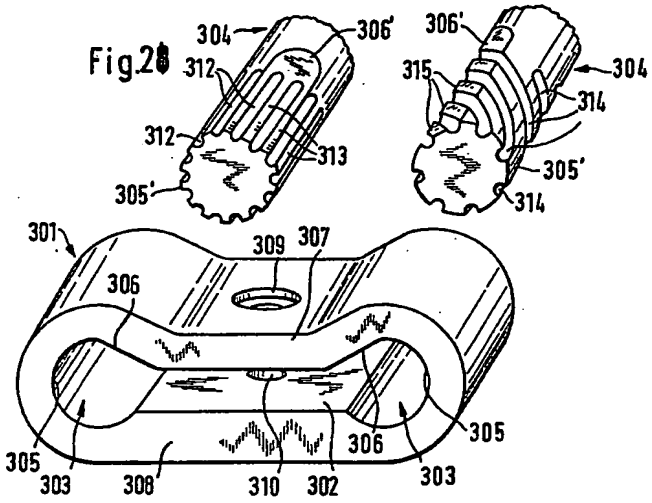
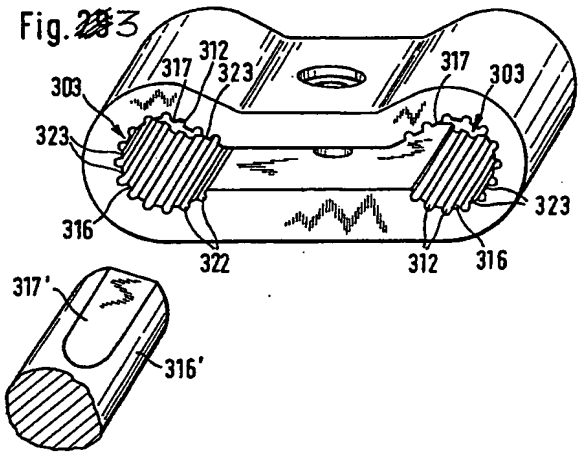


Fig.3



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Sheet 3

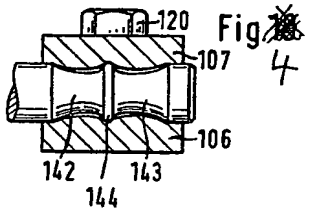

Fig. 4

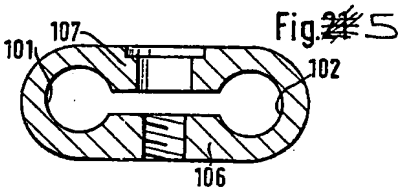

Fig. 5